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(54) Image data communication system and method

(57) In an image data communication system (1), a digital image recording apparatus (2) captures a desired still image or motion video. The digital image recording apparatus (2) compresses, say, a color still image based on JPEG to create a color GIF (graphics interchange format) file. This file is converted into image data having a data amount which can be processed with a portable telephone (9) or a portable information terminal (10). An

image sender transfers the image data generated from the digital image recording apparatus (2) to an image distribution server (7). The image distribution server (7) records the image data in an internal recording apparatus and notifies a recipient that the image is ready for distribution by sending, say, an e-mail message to the portable telephone (9) or the portable information terminal (10).

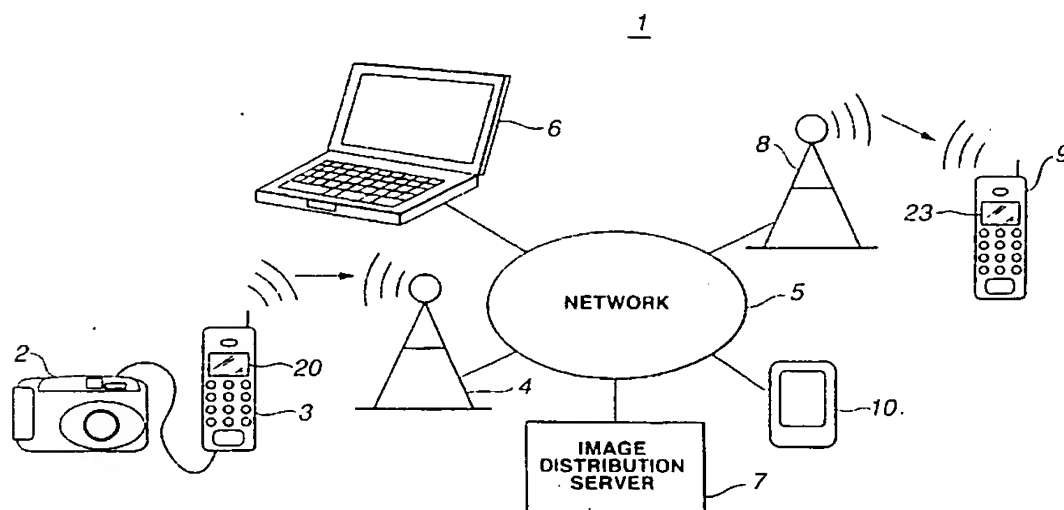


FIG.1

EP 1 161 078 A1

Description

[0001] The present invention relates to an image data communication system and more particularly to an image data communication system and a method thereof for displaying on an image display apparatus an image signal which is generated by imaging a subject.

[0002] The present invention also relates to an image pickup apparatus and an image data processing method used for the image data communication system.

[0003] A portable information device, especially a portable telephone, has a limited image data processing capability and often places limitations on the amount of data and the number of colors as regards available digital images. Accordingly, displaying an image on the portable information device requires advanced knowledge about digital images such as an image retouching program, for example.

[0004] To solve this problem, there are provided a camera dedicated to a portable device for displaying images and a special conversion program for a personal computer. An image is created by using these hardware and software products and is input to the portable device according to a special communication protocol.

[0005] According to an available service, an image processing server is provided on the network. An image is once uploaded to the image processing server. The uploaded image is automatically converted according to the amount of data and the number of colors which can be processed on the portable information device. The converted image is downloaded to the portable information device.

[0006] When the dedicated communication protocol is used for entering the created image to the portable device as mentioned above, special-purpose devices or programs are needed, increasing costs and causing a compatibility problem.

[0007] According to the above-mentioned method, an image processing server is provided on the network and the created image is uploaded for converting the data amount and the number of colors. This method solves the compatibility problem but necessitates additional communication costs. Currently, a mainstream digital still camera is capable of digital images of more than a million pixels, whereas a portable information device supports images of just several tens of thousands of pixels at the most. This results in uploading data several tens of times larger than the number of finally needed pixels, causing unnecessary communication costs. Since the amount of data is compressed considerably, there is a high possibility of degrading the quality of converted images. The conventional method allows confirmation of the image quality only after completion of all processes. There has been frequently a waste of time, communication costs, and charges for the service.

[0008] Various aspects and features of the present invention are defined in the appended claims.

[0009] The present invention has been made in con-

sideration of the foregoing.

[0010] Embodiments of the present invention can provide an image data communication system and a method thereof which can decrease communication costs and time.

[0011] For addressing the above-mentioned problems, an image data communication system according to the present invention comprises: an image pickup apparatus having image pickup means for imaging a subject, wherein the image pickup apparatus converts an image signal from this image pickup means to image data having a data size in compliance with an image display capability of a transmission destination and outputs the image data; and an image display apparatus for displaying an image using the image data output from the image pickup apparatus.

[0012] The data amount does not increase during communication since the image pickup apparatus creates and outputs image data having a data size corresponding to an image display capability of the image display apparatus.

[0013] For addressing the above-mentioned problems, an image data communication method according to the present invention is used for sending image data resulting from imaging a subject by an image pickup apparatus to an image display apparatus as a transmission destination, comprising: an image data processing step of converting an image signal captured by image pickup means of the image pickup apparatus to image data of a data size corresponding to an image display capability of the image display apparatus as a transmission destination; a communication step of transmitting the image data resulting from the image data processing step to the image display apparatus; and an image display step of receiving the image data transmitted by the communication step and displaying the image data as an image on the image display apparatus.

[0014] The data amount does not increase during communication since the image data processing step creates image data of a data size corresponding to an image display capability of the image display apparatus.

[0015] For addressing the above-mentioned problems, an image pickup apparatus according to the present invention comprises: image pickup means for imaging a subject; image data processing means for generating image data having a data size in compliance with an image display capability of an image display apparatus from an image signal captured by the image pickup means; and output means for outputting the image data generated by the image data processing means.

[0016] For solving the above-mentioned problems, an image data processing method according to the present invention is used for generating image data from an image signal obtained by imaging a subject and displaying the image data on an image display apparatus by means of communication, comprising: an image data processing step of converting the image signal to image data of

a data size in compliance with an image display capability of the image display apparatus.

[0017] The present invention can provide an image data communication system and a method thereof which can decrease communication costs and time.

[0018] The invention will now be described by way of example with reference to the accompanying drawings, throughout which like parts are referred to by like references, and in which:

FIG. 1 shows a configuration of an image data communication system according to an embodiment of the present invention;

FIG. 2 is a block diagram showing a configuration of a digital image recording apparatus constituting the image data communication system;

FIG. 3 is a flowchart showing an image compression algorithm when the digital image recording apparatus compresses an image;

FIG. 4 illustrates a sequence of operations in which image data received by a digital image recording apparatus is temporarily stored in an image distribution server networked via a portable telephone and is displayed on the portable telephone;

FIG. 5 illustrates a sequence of operations in which a GIF file with additional data from a digital image recording apparatus is temporarily uploaded to an image distribution server via a personal computer and then is sent to a portable telephone; and

FIG. 6 shows an example of a display content in a display section of a receiving portable telephone.

[0019] Embodiments of the present invention will be described in further detail with reference to the accompanying drawings. As an embodiment, FIG. 1 shows an image data communication system 1 which comprises a digital image recording apparatus 2 and a portable telephone 9. The digital image recording apparatus 2 works as an image pickup apparatus. The portable telephone 9 works as an image display apparatus for displaying an image by using image data output from the digital image recording apparatus 2.

[0020] In this image data communication system 1, the digital image recording apparatus 2 is connected to a portable telephone 3. The portable telephone 3 sends and receives an RF signal to/from a base station 4 connected to a wire network 5 such as the Internet via a wireless transmission path. The portable telephone 9 sends and receives an RF signal to/from a base station 8 connected to the wire network 5 via a wireless transmission path.

[0021] The network 5 may connect with an image processing apparatus 6 such as a personal computer and a portable information terminal 10 such as a PDA. The network 5 may connect with an image distribution server 7.

[0022] In the image data communication system 1 as shown in FIG. 1, an image sender uses the digital image

recording apparatus 2 to capture a desired still image or motion video (hereafter simply referred to as an image). The digital image recording apparatus 2 compresses the image and records it in a recording section so that a data amount is appropriate for processing on the portable telephone 9 or the portable information terminal 10. It is assumed that, say, a 5-KB data amount is appropriate for processing on the portable telephone 9 or the portable information terminal 10. This data amount is based on a recording medium capacity in the portable telephone 9 or the portable information terminal 10 and a speed of a data transmission service for mobile communication. The above data amount may be increased when a next-generation high-speed mobile communication service is available in the future. The digital image recording apparatus 2 images a subject to generate, say, a color still image. This image is compressed according to the JPEG format and is further compressed as a color GIF (graphics interchange format) file so that the data amount is appropriate for processing on the portable telephone 9 or the portable information terminal 10. At this time, it may be preferable to temporarily compress the captured color still image as a JPEG file and then as a GIF file.

[0023] The image sender connects the digital image recording apparatus 2 to the portable telephone 3 which establishes a connection to the network 5. The recorded 5-KB image data is transferred to the image distribution server 7. The image distribution server 7 records the image data transferred from the digital image recording apparatus 2 on an internal recording apparatus. The image distribution server 7 then sends an e-mail message to the portable telephone 9 or the portable information terminal 10 to notify a recipient that image distribution is available. The recipient can download to receive the image from the image distribution server 7 by operating the portable telephone 9 or the portable information terminal 10.

[0024] In the above description, the image distribution server 7 temporarily stores image data. The present invention also permits a system configuration without the image distribution server 7. In this case, the image sender connects the digital image recording apparatus 2 to the portable telephone 3 and directly transfers image data to the recipient's portable telephone 9 or portable information terminal 10.

[0025] In the description so far, the digital image recording apparatus 2 is connected to the portable telephone 3. This is an example of means for connecting the digital image recording apparatus 2 to the network 5. Instead of the portable telephone 3, it may be preferable to use connection means such as a stationary telephone and a networked personal computer. It may be also preferable to directly connect the digital image recording apparatus 2 to the network 5 by eliminating the portable telephone 3. In this case, the digital image recording apparatus 2 may be not only a camera and a scanner, but also a CCD-camera equipped PDA or port-

able telephone.

[0026] An image sending source may be the image processing apparatus 6 connected to the network 5. In this case, the sender converts a prepared image using the image processing apparatus 6 so that the data amount is appropriate for processing on the portable telephone 9 or the portable information terminal 10. Thereafter, the image is distributed via the network 5 as mentioned above.

[0027] The following describes detailed configuration and operations of the digital image recording apparatus 2 with reference to FIGS. 2 and 3. In the digital image recording apparatus 2 as shown in FIG. 2, a CCD 11 works as image pickup means for imaging a subject and generates an image signal. An image processing circuit 12 processes the image signal and outputs image data with a data size which complies with an image display capability of the destination such as the portable telephone 9 or the portable information terminal 10.

[0028] An image captured by the CCD 11 is processed in the image processing circuit 12 and is displayed on the image display apparatus 13. The image display apparatus 13 can be a built-in LCD panel or EVF display, an externally connected TV monitor, and the like.

[0029] When a user presses a shutter button 15, an image captured by the CCD 11 is temporarily recorded in DRAM 14 via the image processing circuit 12. The image data recorded in the DRAM 14 is compressed by the image processing circuit 12 and is written back to the DRAM 14. The compression follows an algorithm as shown in the flowchart of FIG. 3 to be described later. During the compression, data is compressed to an amount which can be processed by the portable telephone 9 or the portable information terminal 10. The compressed image data written back to the DRAM 14 is recorded in a memory card 18 via a memory card controller 17.

[0030] For reproducing an image recorded in the memory card 18, the compressed image data is read from the memory card 18 via the memory card controller 17 and is recorded in the DRAM 14. The compressed image data is expanded in the image processing circuit 12 and is written back to the DRAM 14. The image data written back to the DRAM 14 is processed in the image processing circuit 12 and is displayed on the image display apparatus 13.

[0031] For transferring an image recorded in the memory card 18 to a portable telephone, the compressed image data is read from the memory card 18 via the memory card controller 17 and is recorded in the DRAM 14. The compressed image data recorded in the DRAM 14 is transferred to the portable telephone 9 via the I/F circuit 19.

[0032] A controller microcomputer 16 controls transfer of image data between the blocks. In the above description, compressed image data is recorded in the memory card 18. The system configuration may use re-

movable built-in nonvolatile memory for storing compressed image data.

[0033] The following describes an image compression algorithm with reference to FIG. 3 when the digital image recording apparatus 2 compresses an image.

[0034] When the image compression starts, it is checked whether to compress one image or a plurality of images (step S1). Here, a plurality of images refers to a plurality of still images and a plurality of motion images.

[0035] When one image is to be compressed, control advances to step S2 to set a predefined value P as an initial compression rate. The compression rate P is a provisional term used for explaining a compression degree. In actual processing, a compression rate may comprise a plurality of parameters. When the compression rate P is specified, the image is compressed according to the specified value at step S3. When the compression is complete, the resulting image data amount is checked at step S4. When the data amount is smaller than or equal to the predefined value, the compression terminates. This predefined value corresponds to a size capable of processing in the portable telephone 9 or the portable information terminal 10. When the data amount exceeds the specified value, the compression rate P is increased by amount d% (step S5). The compression is repeated at S3. This processing is repeated until the compressed image data amount becomes smaller than or equal to the specified value. According to this algorithm, the compression rate is increased by d% at step S5. It may be preferable to determine the compression rate by providing a compression rate table or using a function for finding the compression rate.

[0036] When a plurality of images (N images) is to be compressed at step S1, a value P/N is specified as an initial compression rate (step S6) and the compression is performed (step S7). Thereafter, the image data amount is checked at step S8. When the data amount is smaller than or equal to the specified value, the compression terminates. When the data amount exceeds the specified value, the compression rate is increased by amount d% (step S9) and the compression is reexecuted (step S7). This processing is repeated until the image data amount becomes smaller than or equal to the specified value. With respect to the compression rate P/N, a value 1/N indicates that the compressed data amount should be controlled likewise for one image and a plurality of images. However, the value 1/N does not always take effect depending on an image characteristic. Like the case for one image, there can be several methods of setting the amount d% for increasing the compression rate.

[0037] In the above algorithm, the specified data amount value may be stored in the nonvolatile memory of the digital image recording apparatus or entered by a user.

[0038] With reference to FIG. 4, the following describes a sequence of operations in the image data com-

munication system 1. Namely, 5-KB image data received by the digital image recording apparatus 2 is temporarily stored in the image distribution server 7 connected to the network 5 via the portable telephone 3 and is displayed on the portable telephone 9.

[0039] For example, 5-KB image data is captured by the digital image recording apparatus 2, and is converted to a color GIF file having a data amount which can be processed in the portable telephone 9. The image data is displayed on a display section 20 of the portable telephone 3. This display section 20 is the same as the image display apparatus 13 in FIG. 2. At this time, the 5-KB data (color GIF file) is provided with additional data such as a mail address, an image file name, a message, and the like according to key operations on the portable telephone 3. When a transfer button is operated on the display section 20, the GIF file with additional data is uploaded to the image distribution server 7 via the wireless transmission path and the wire network 5 (1). The image distribution server 7 generates a URL and a mail message in a specified mode and sends this message to the portable telephone 9 (2). When the portable telephone 9 is used to access the URL sent from the image distribution server 7 (3), the GIF file is downloaded from the image distribution server 7.

[0040] FIG. 5 illustrates a sequence of operations in which a GIF file with additional data from the digital image recording apparatus 2 is temporarily uploaded to an image distribution server 7 via a personal computer 60 and then is sent to the portable telephone 9.

[0041] The personal computer 60 activates software for uploading images. A press of a send button on the personal computer 60 transmits a customer ID and a password (provisional ID and password) to the image distribution server 7 according to the HTTPS protocol (1). The image distribution server 7 checks an authentication server 21 based on the ID and password transmitted from the personal computer 60 (2). The image distribution server 7 then returns a result of checking the ID and password to the personal computer 60 (3).

[0042] When the image distribution server 7 returns a successful check result, the software active on the personal computer 60 uses the HTTPS protocol to send to the image distribution server 7 a customer ID and password (provisional ID and password), a password for viewing GIF files, a sender name, a sender's mail address, a recipient name, a specified mail address, a 5-KB GIF file, a message attached to an image, and the like (4).

[0043] Based on the transmitted data, the image distribution server 7 generates a mail message in a specified mode, a URL, and HTML files for a password check screen and a viewer page (5). The image distribution server 7 returns a processing result to the personal computer 60.

[0044] Then, the image distribution server 7 sends a mail message in a specified mode to a mail server 22 according to a fixed mail format used for the mail server

22 (7). The mail server 22 distributes the mail message in the specified mode to the portable telephone 9 (8). When the above mail message causes an error, the error mail message is returned to the image distribution server 7 (9).

[0045] FIG. 6 shows an example of a mail message in a specified mode distributed to the portable telephone 9 and displayed on a display section 23 thereof. When a recipient clicks the URL, he or she is prompted to enter a password for viewing the GIF file. After the password is entered successfully, the GIF file can be viewed.

[0046] The image data communication system 1 has been described in detail. As mentioned above, the digital image recording apparatus 2 creates beforehand an image compressed to the data amount which can be processed in the receiving portable telephone or portable information terminal. This can minimize the data amount to be uploaded to the network 5, thus decreasing communication costs and time.

[0047] After the data amount is decreased, the image quality can be confirmed before data transfer. This can prevent a failure of wasting communication costs and time when the image quality is found to be unsatisfactory after the data transfer.

[0048] The network does not always need to have a server for converting images, making the system configuration easy. It is possible to decrease costs for the system configuration and operations.

[0049] It is unnecessary to use dedicated image recording equipment or communication protocol, decreasing costs and ensuring versatility.

[0050] In so far as the embodiments of the invention described above are implemented, at least in part, using software-controlled data processing apparatus, it will be appreciated that a computer program providing such software control and a storage medium by which such a computer program is stored are envisaged as aspects of the present invention.

[0051] Various different aspects and features of the present invention are defined in the appended claims. Combinations of features from the dependent claims may be combined with features of the independent claims as appropriate and not merely as explicitly set out in the claims.

Claims

1. An image data communication system comprising:

an image pickup apparatus having image pickup means for imaging a subject,
said image pickup apparatus converts an image signal from this image pickup means to image data having a data size in compliance with an image display capability of a transmission destination and outputs said image data; and
an image display apparatus for displaying an

- image using said image data output from said image pickup apparatus.
2. The image data communication system according to claim 1, wherein said image pickup apparatus records said image signal on a recording medium. 5
 3. The image data communication system according to claim 1, wherein said image pickup apparatus converts said image signal to the image data having the data size in compliance with the image display capability of a transmission destination and then records said image data on said recording medium. 10
 4. The image data communication system according to claim 1, wherein said image display apparatus is a portable terminal having an image display capability. 15
 5. The image data communication system according to claim 1, wherein said image pickup apparatus uses a subtractive color process to convert said image signal to the image data having the data size in compliance with the image display capability of said transmission destination. 20
 6. The image data communication system according to claim 1, wherein said image data output from said image pickup apparatus is sent to said image display apparatus at least via a wire network. 30
 7. The image data communication system according to claim 6, wherein said image data output from said image pickup apparatus is uploaded with said data size unchanged to an image storage server connected to said wire network. 35
 8. The image data communication system according to claim 7, wherein said image display apparatus downloads said image data from said image storage server. 40
 9. The image data communication system according to claim 1, wherein said image data output from said image pickup apparatus is sent to said image display apparatus via a wireless transmission path and a wire network. 45
 10. The image data communication system according to claim 9, wherein said image data output from said image pickup apparatus is uploaded with said data size unchanged to said image storage server connected to said wire network. 50
 11. The image data communication system according to claim 10, wherein said image display apparatus downloads said image data from said image storage server. 55
 12. The image data communication system according to claim 1, wherein said image pickup apparatus is connected to communication means and said image data is output to said image display apparatus via said communication means.
 13. The image data communication system according to claim 1, wherein said image pickup apparatus comprises said communication means and outputs said image data to said image display apparatus via said communication means.
 14. The image data communication system according to claim 1, wherein said image display apparatus comprises said communication means and receives said image data via said communication means.
 15. An image data communication method for sending image data resulting from imaging a subject by an image pickup apparatus to an image display apparatus as a transmission destination, comprising:
 - an image data processing step of converting an image signal captured by image pickup means of said image pickup apparatus to the image data having a data size corresponding to an image display capability of said image display apparatus as said transmission destination;
 - a communication step of transmitting said image data resulting from said image data processing step to said image display apparatus; and
 - an image display step of receiving said image data transmitted by said communication step and displaying said image data as an image on said image display apparatus.
 16. The image data communication method according to claim 15, wherein said image data processing step uses a subtractive color process to convert said image signal to said image data having the data size in compliance with said image display capability of said image display apparatus as said transmission destination.
 17. The image data communication method according to claim 15, wherein said communication step uses a wireless transmission path and/or a wire network to transmit said image data to said image display apparatus.
 18. An image pickup apparatus comprising:
 - image pickup means for imaging a subject;
 - image data processing means for generating image data having a data size in compliance with an image display capability of an image

display apparatus from an image signal captured by said image pickup means; and output means for outputting said image data generated by said image data processing means.

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19. The image pickup apparatus according to claim 18, further comprising communication means for transmitting said image data to said image display apparatus.

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20. The image pickup apparatus according to claim 18, wherein said image signal is recorded on a recording medium.

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21. The image pickup apparatus according to claim 18, wherein said image signal is converted to the imaged data having the data size in compliance with said image display capability of said image display apparatus by the said image data processing means and thereafter recorded on said recording medium.

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22. An image data processing method for generating, from an image signal obtained by imaging a subject, image data to be displayed on an image display apparatus by means of communication, comprising:
an image data processing step of converting said image signal to the image data having a data size in compliance with an image display capability of said image display apparatus.

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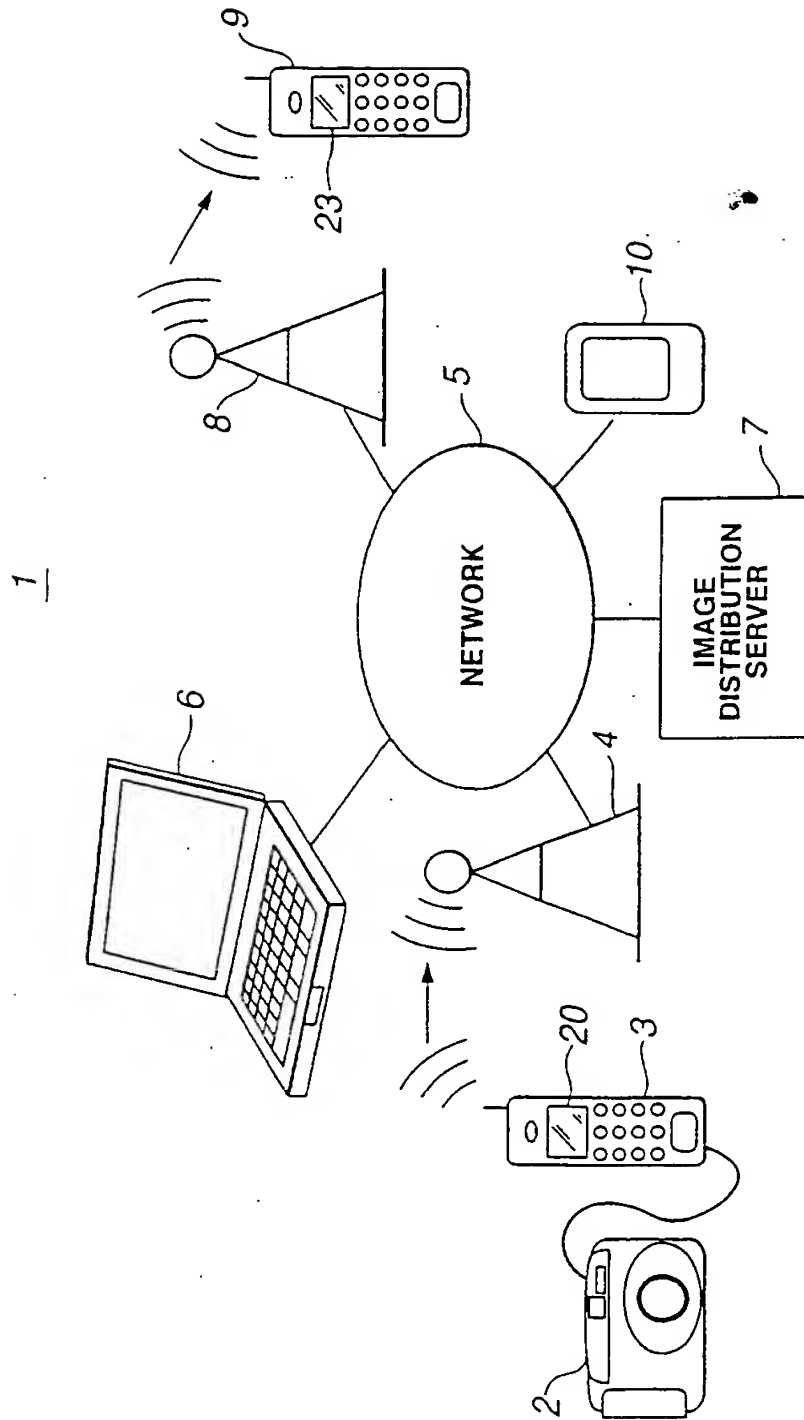


FIG.1

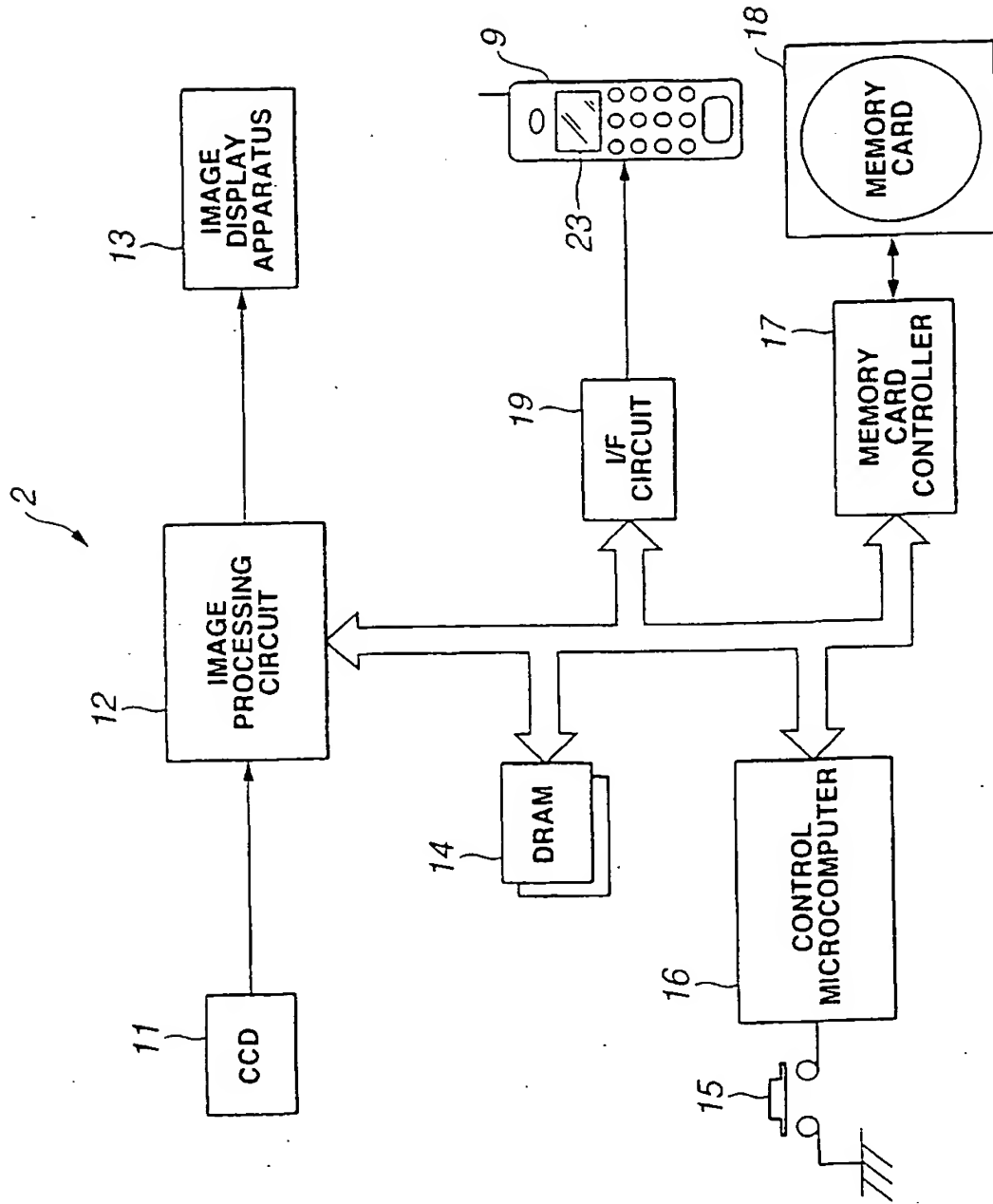


FIG.2

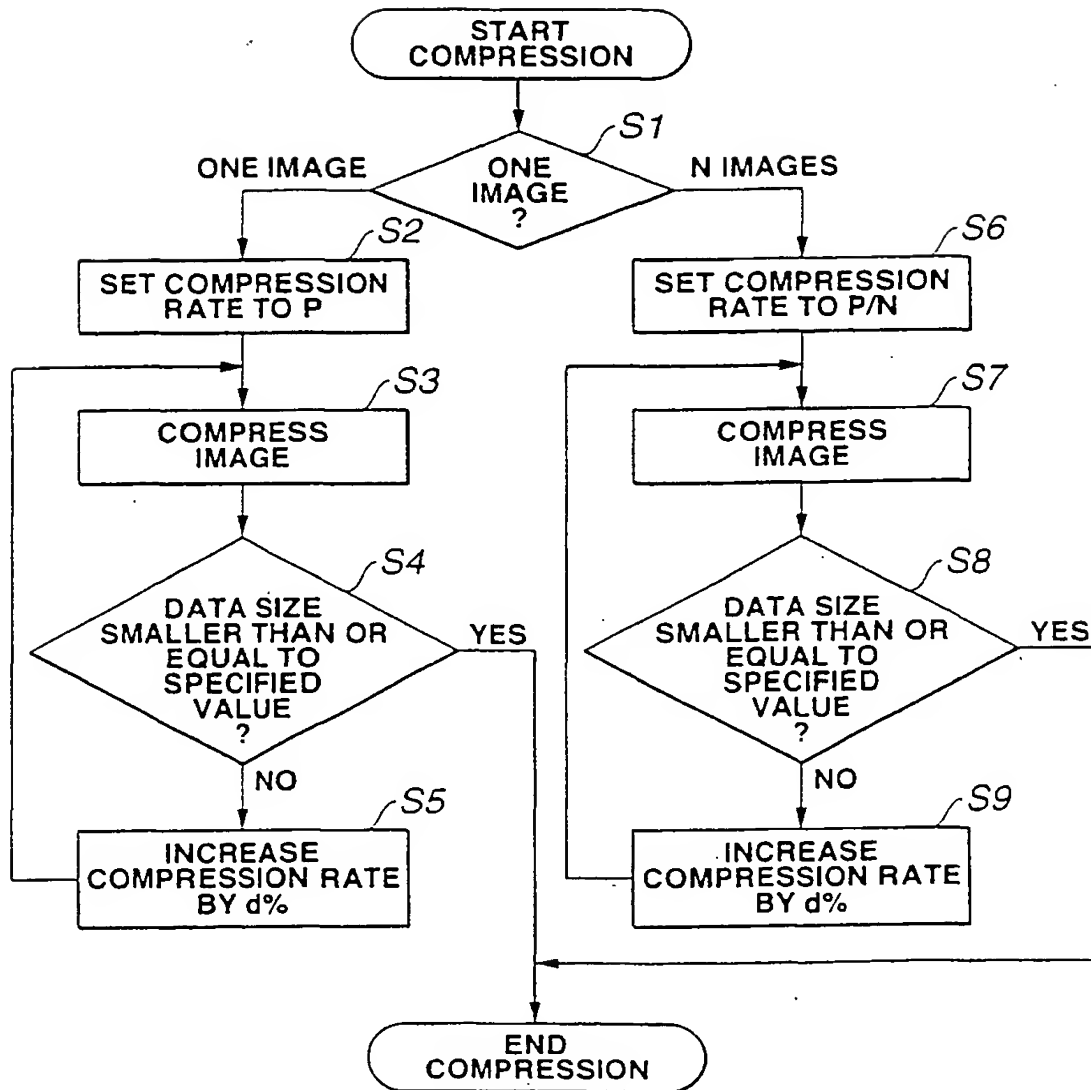


FIG.3

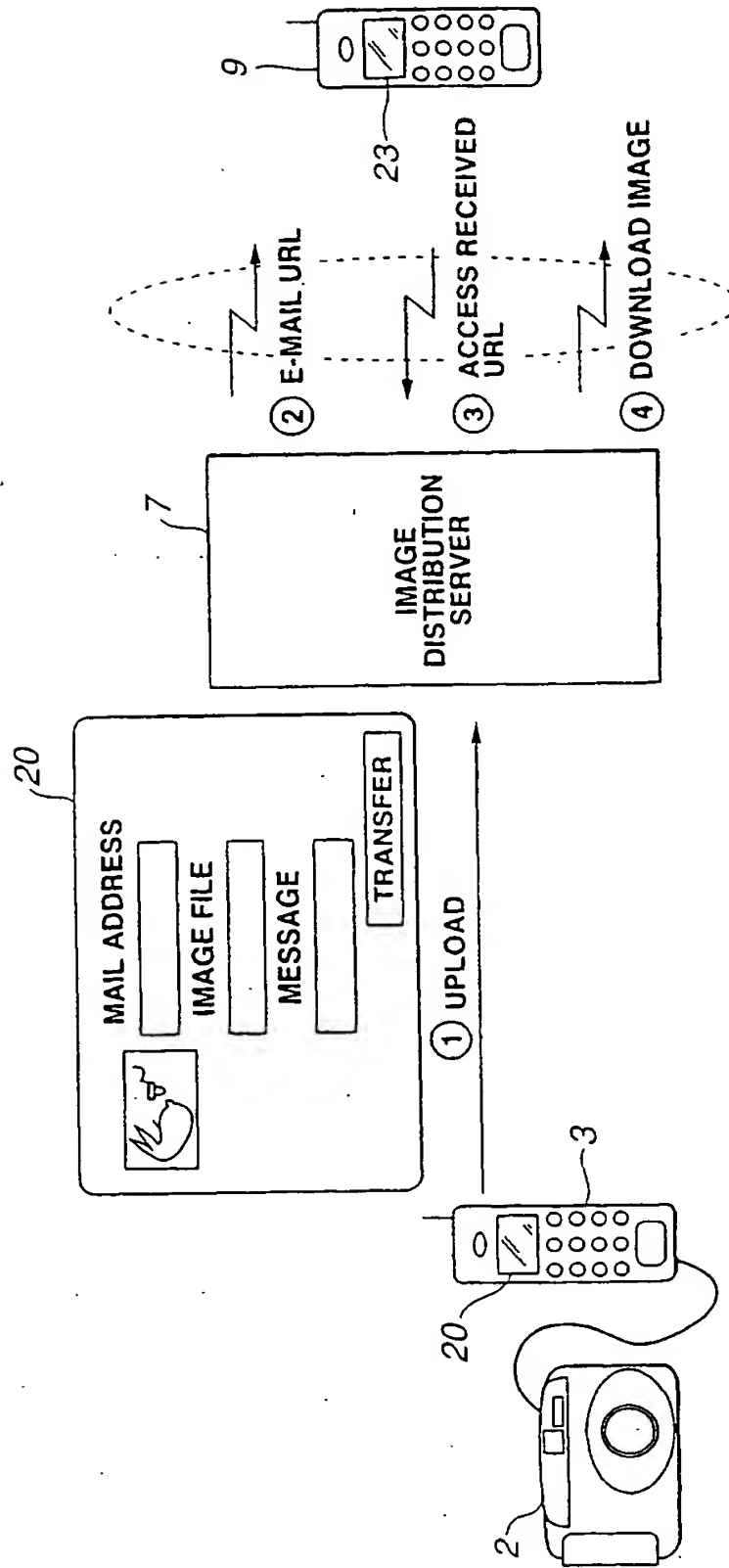


FIG.4

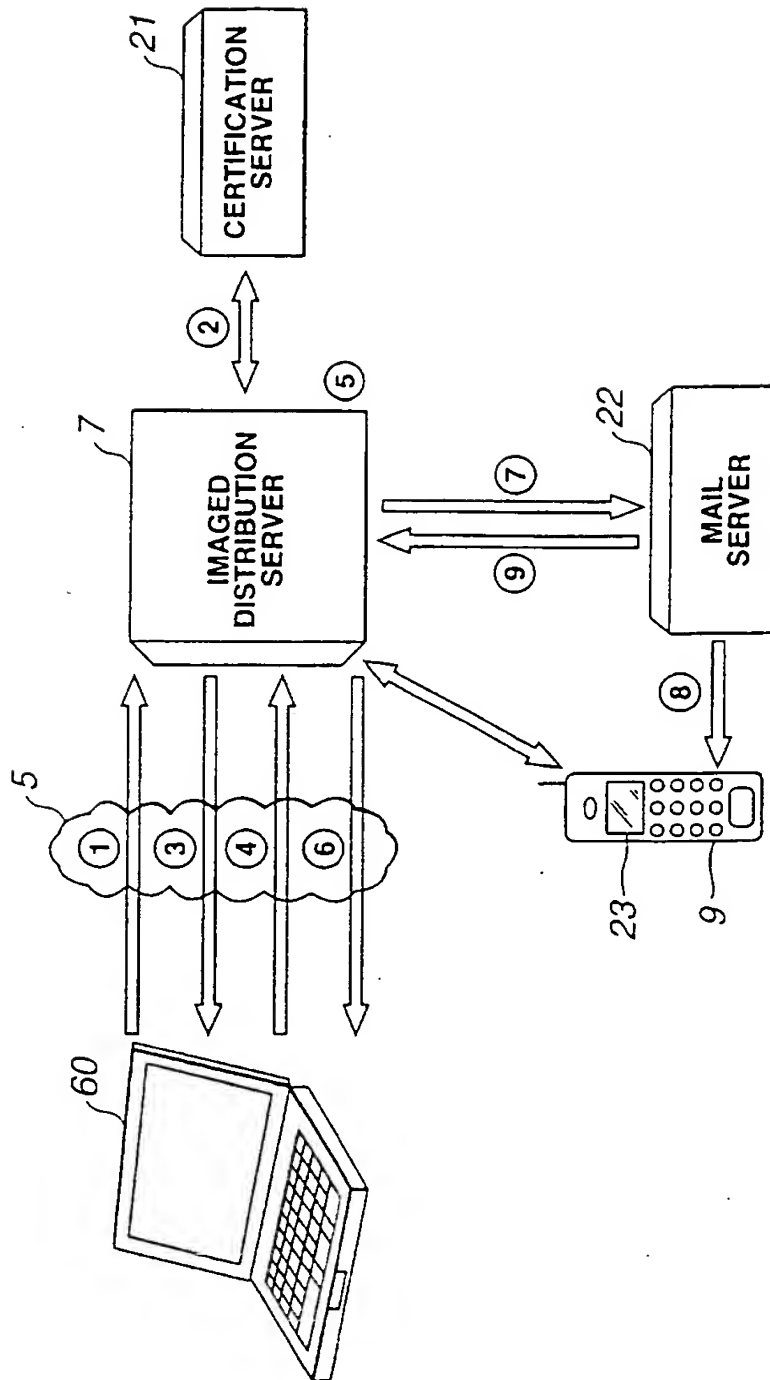


FIG.5

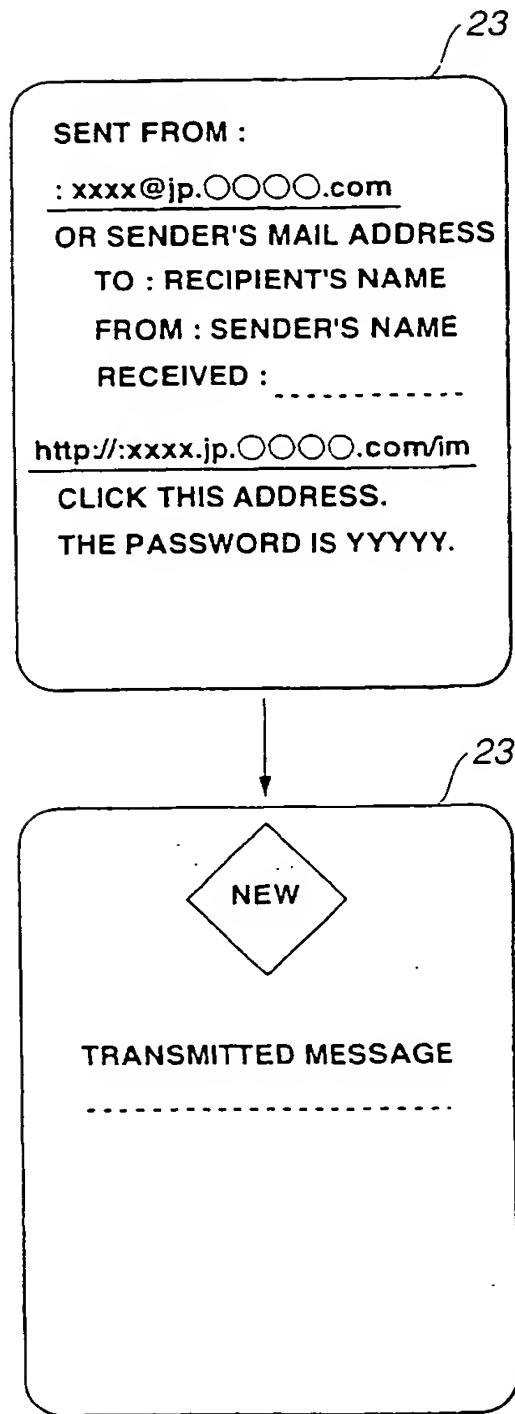


FIG.6



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 01 30 4606

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	WO 99 35817 A (RAYTHEON CO ;MONROE DAVID A (US)) 15 July 1999 (1999-07-15) * abstract * * page 4, line 2 - line 11 * * claims 1-27 *	1-22	H04N1/21 H04N1/333
X	EP 0 889 636 A (FUJI PHOTO FILM CO LTD) 7 January 1999 (1999-01-07) * abstract * * figure 1 * * claim 23 *	1-22	
X	EP 0 905 966 A (CANON KK) 31 March 1999 (1999-03-31) * abstract * * column 3, line 40 - column 3, line 41 * * column 5, line 44 - column 5, line 48 * * figures 1,4,8,8,11,15, *	1-22	
A	US 6 038 295 A (MATTES HEINZ) 14 March 2000 (2000-03-14) * abstract * * figures 2,3 *	1-22	TECHNICAL FIELDS SEARCHED (Int.Cl.7) H04N
A	WO 97 26744 A (ROBB GARRY DOUGLAS) 24 July 1997 (1997-07-24) * abstract * * page 1, line 1 - page 2, line 7 *	1-22	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 7 September 2001	Examiner Stoffers, C
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 01 30 4606

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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07-09-2001

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 9935817	A	15-07-1999	US 6181954 B	30-01-2001
			AU 2221099 A	26-07-1999
			EP 1055320 A	29-11-2000
EP 0889636	A	07-01-1999	AU 722579 B	10-08-2000
			AU 7395498 A	07-01-1999
			JP 11073295 A	16-03-1999
			JP 11073382 A	16-03-1999
			JP 2000030073 A	28-01-2000
EP 0905966	A	31-03-1999	JP 11168612 A	22-06-1999
US 6038295	A	14-03-2000	EP 0814611 A	29-12-1997
			JP 10070631 A	10-03-1998
WO 9726744	A	24-07-1997	AU 1363697 A	11-08-1997
			CA 2243244 A	24-07-1997
			CN 1208529 A	17-02-1999
			EP 0875109 A	04-11-1998
			TR 9801383 T	21-10-1998
			US 6177950 B	23-01-2001

EPO FORM P4459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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